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The conference defined the parameters of an information system to satisfy the needs of local districts for access to and use of the results of R & D in education. Elements of the design are (1) output (needs of local personnel), (2) input (content, location, and organization of data), (3) process (existing developments and services), and (4) roles of national, regional, state, and local districts in the system. Areas analyzed were (1) the problem, (2) existing conditions, (3) a model system, (4) feasibility, and (5) the components most urgently needed. Much of the R & D done by universities, foundations, and even other school districts must be translated to a different form for others' use. The proposed system would (1) collect data, (2) prepare, index, and maintain files, (3) provide interface with users, (4) apply data to classroom users, and (5) manage the system. Present constraints on its ideal use include (1) lack of (a) standardization, (b) sophisticated users, and (c) criteria for system evaluation, (2) existing services and interests, (3) present hard- and software, (4) development and operation costs, and (5) legal limits on reproduction of material. Techniques are now adequate for processing and storing, but not for indexing and reformulation. The greatest flaw is at the system/user interface. The laboratory could profitably train information specialists in each district, prepare summaries on major subject areas, and issue annual reviews on R & D in education. (HH)

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EDUCATIONAL R&D INFORMATION SYSTEM REQUIREMENTS

A TASK FORCE REPORT

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EDUCATIONAL R & D INFORMATION
SYSTEM REQUIREMENTS:
A Task Force Report

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JUL 12 1968

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JUNIOR COLLEGE
INFORMATION

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ABSTRACT

During the summer of 1967, the Far West Laboratory for Educational Research and Development created a Task Force to assist in the formulation of one of its Communication Program components. The purpose of the Task Force was to determine and define the content and scope of an information system which could assist local school districts in locating and using the results of research and development (R and D) in education. Participants focused their discussion on four areas of system design:

1. Output - the information requirements of local school personnel

2. Input - the content, location, and organization of information

3. Process - existing and planned information services and technological developments

4. Roles - national, regional, state, county and district functions in relation to an educational R and D system.

This report presents the outcome of expert discussion and analysis of the above areas in answer to the following five questions: What is the problem? What are the existing conditions? What might constitute a model system? What are the practical possibilities? What system components are most needed at present?

The major problem arises from the need of school personnel for improved means to obtain useful information about educational R and D.

Effective use of R and D information under existing conditions requires the cooperation of many levels within the educational system. Initially, research and development is supported and/or performed by universities, foundations, and some school districts. The R and D results, however, are seldom in a form that can be applied directly in the schools; they must be summarized, interpreted, and translated into usable forms. These functions are imperfectly rendered by the curriculum specialist, who is becoming a less common feature at the district level while his role is becoming more important.

At present, administrators have the largest impact upon policy decisions to adopt improved practices in schools, although teachers are striving for greater influence.

Furthermore, the information requirements of the several groups participating in the change process vary. The present information network provides great masses of information. Informal subsystems serve researchers and administrators only moderately well.

The proposed model information system would satisfy all reasonable user needs without regard to cost, technology, or manpower availability. Several major functions are considered: (1) collection of information; (2) preparation, indexing and maintenance of files; (3) interface with users; (4) application of information to classroom problems; and (5) system management. Practical alternatives for these five functions are also suggested.

The following practical constraints which may prevent the ideal information system from achieving its potential are discussed: inadequate taxonomy; lack of standardization; lack of an "engineering" function; existing services and interests; unsophisticated user population; differing national and regional interests; lack of system evaluation criteria and methodology; available hardware and software; cost of development and operation; and legal sanctions.

An examination of system components revealed that the present operations or developmental efforts of some organizations meet identified system requirements. The collection process is performed on the national level by fairly well-organized systems such as the Educational Resources Information Center. However, a national system is not appropriate for the acquisition of information on local projects which may have, at best, regional interest.

Existing techniques seem to be reasonably adequate for processing, filing, and storage. The areas of indexing and reformulation, however, exhibit significant weaknesses, while the greatest breakdown occurs at the user interface.

In response to the needs and problems discussed in the report, the Task Force suggested three possible roles for the Far West Laboratory: (1) training and support of information specialists in each school district in the region; (2) preparation, production, and distribution of interpretive summaries on subject areas of major interest; and (3) preparation of an annual review of educational R and D.

Educational R & D Information System Requirements - A Task Force Report

I. INTRODUCTION

Title IV of the Elementary and Secondary Education Act of 1965 (Public Law 89-10) created regional educational laboratories to conduct programmatic research and development so that proven innovations in education can find practical application in the nation's schools at the earliest possible date. The Act specifies that the laboratories are to identify educational problems, to conduct and coordinate research and research-related activities in problem areas, and particularly to disseminate findings for implementation in the schools.

The Far West Laboratory for Educational Research and Development has undertaken two major research and development (R and D) programs and a number of auxiliary projects. The primary R and D program, concerned with developing and implementing more effective inservice training for teachers, is presently producing a series of minicourses which will employ microteaching techniques in four specific areas: basic teaching skills, skills for instructing nontypical student groups, skills required in new instructional programs, and skills needed for effective employment of new curricula.

The secondary R and D program of the Laboratory seeks to improve dissemination and productive use of research and development information by school personnel who make decisions affecting school organization and operation. The objectives of this program are (1) to develop motivation among school personnel to learn about new developments in education, (2) to provide efficient systems through which school personnel can have ready access to relevant information, and (3) to develop organizational arrangements within school systems and support training programs so that school personnel will be able to use R and D information effectively.

To attain these objectives, a coordinated and systematic research, development, and implementation effort has been initiated through the components described below.

Component 1: Development of Attitudes and Realistic Expectations. This component uses mass media to inform teachers and other school personnel about significant innovations and research-based developments in education. Specific activities within this component include experimentation with broadcast television and film as means of developing motivation and knowledge; preparation and distribution of written handbooks for educators; and conduct of a series of surveys among school personnel to determine their interest in, knowledge of, and attitudes toward educational innovation, research and development.

Component 2: Design of and Experimentation with Systems Through Which School Personnel Can Have Access to Relevant Information in Usable Forms. Two related activities are being undertaken in this component. The one which produced this report involves the collection of data on information needs and system requirements. The other focuses on the development, field testing, and implementation of model information systems.

Component 3: Development of Organizational Arrangements Within Schools to Utilize Information Effectively. This component includes three activities: study of educational decision making and change processes as they relate to information requirements; identification and analysis of specific organizational arrangements and training programs that will facilitate effective use by school personnel of R and D information; and pilot tests of selected arrangements and programs in school systems.

As its first major task, the Laboratory has sought to define its particular interest in each component and to plan appropriate strategy. Five activities specifically related to Component 2 (Information Systems) have been initiated: (1) the Communication and Utilization Study for Educational Research and Development, completed through contract with Lockheed Missiles and Space Company; (2) the Formulating Educational Problems Project, conducted under contract with the American Institutes for Research (AIR) in an effort to develop systems which identify educational needs and then articulate them into well-defined problems; (3) a review of literature and a field study on how research-derived information is used by various levels of school personnel, conducted under contract with the Stanford Research Institute; (4) studies and reviews by Laboratory staff; and (5) a detailed study and analysis of educational information system requirements by a specially selected Task Force.

The Task Force was chosen as a reasonable means to define the problem area in a rapid, yet comprehensive manner. After several weeks of planning, the Task Force first convened on 25 July 1967. Permanent members included Robert Coney, Chief Assistant Superintendent of the Alameda County Schools; Vern Plaskett, information systems analyst from the Lockheed Missiles and Space Company; Robert Roggenbuck, information systems analyst and manager of the Arizona Field Office, URS Corporation; and Paul Hood, research psychologist and program director of the Far West Laboratory for Educational Research and Development. Before adjourning on 30 August 1967, the Task Force held four working sessions on the following topics:

1. Output - the requirements of local school personnel

2. Input - the content, organization, and location of information

3. System - existing and planned information services and technological developments

4. Roles - national, regional, state, county and district functions in relation to an educational R and D system.

Consultants joined the permanent members of the Task Force at each work session. Those attending the user requirement session were: Virgil Blanke, School of Education, Ohio State University; Marvin Hockabout, Alameda Unified School District; Wayne Otto, Research and Development Center for Cognitive Learning, University of Wisconsin; and Richard Schmuck, Center for the Advanced Study of Educational Administration, University of Oregon. Twenty-nine other participants, including elementary and high school teachers and principals and personnel from professional and research associations, state departments of education, county schools, and local school districts, were invited to attend hearings on user requirements (see Appendix A).

Consultants for the session on the content and organization of information were: Robert Gagné, School of Education, University of California, Berkeley; William Gephart, Director, School Research Information Service, Phi Delta Kappa; and John Loughary, School of Education, University of Oregon. Twenty participants attended hearings on this topic.

The session on information systems had two consultants: Robert Hayes, School of Library Science, U.C.L.A., and Harold Borko, Systems Development Corporation. Three observers attended that session, but no hearings were scheduled. At the conclusion of the session, a second hearing on user requirements was called to reexamine earlier information. Six district coordinators, directors, or consultants in the areas of curriculum, instruction, or guidance attended.

Sixteen participants attending a final two-day conference on roles represented the U.S. Office of Education, the California State Department of Education, the Nevada State Department of Education, the California Teachers Association, the California School Board Association, the Contra Costa and San Mateo Supplementary Education Centers, the San Mateo County School Office, and the Far West Laboratory for Educational Research and Development.

Agenda and lists of participants for these sessions appear in Appendix A.

II. PROBLEM DEFINITION

The main objective of the Task Force was to develop a requirements specification defining the desired characteristics of an educational R and D information system to serve local schools in terms of (1) the user, (2) the input elements, and (3) the information services provided. Through an intensive, concentrated effort involving direct confrontation of analysts, providers, and users of educational R and D data, the Task Force aimed to produce a thorough understanding both of the elements of an information system and of the possible contribution of the Laboratory's Communication Program.

Since it is possible to view the entire educational process in terms of information and communication, it is immediately necessary to impose limits on the system. The user population is therefore defined provisionally as school personnel at or below the county and district level. The content categories are restricted to those types of information derived directly or indirectly from any phase of the research and development continuum, with special emphasis on applied research. These categories may also include inventions and innovations which have direct bearing on classroom learning. There are no restrictions on services, per se.

Specifically excluded from consideration are the needs of other consumers of educational R and D, such as graduate students, university educational researchers, federal and state educational administrators, and business and industrial producers and trainers. Similarly, information content which is concerned primarily with personnel, fiscal reporting, or other types of management problems is excluded.

A basic assumption of such an information system is that the improvement of American education does not depend only upon systematic investigation of the educational process, the necessary conditions for learning, and the consequent development of strategies, technology, and materials. It also requires awareness of, rational choice among, and successful adoption and implementation of instructional strategies, educational technology, and materials in the schools. Among a number of problems which any educational change practitioner must consider is that of creating an awareness of and providing information about alternatives.[1] Although the Task Force at times questioned the validity of the basic assumption, it did accept as a starting point the premise that something could be done to improve the present conditions and means whereby operating and planning school district personnel can obtain relevant educational R and D information. Basic questions such as the following were posed:

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[1] See for example, Planning and Effecting Needed Change in Education, edited by E. L. Morphet and C. O. Ryan, N.Y., Citation Press, 1967.

1. What are the existing conditions?
2. What might be a model system?
3. What are the practical possibilities?
4. What is most needed?

III. DESCRIPTION OF EXISTING CONDITIONS

This section describes present conditions in public elementary and secondary education which impinge upon the adoption of improved instructional practices. Excluded from this discussion are those operations which are restricted to the maintenance of on-going activities or whose primary purpose is non-innovative, but make some peripheral contribution to implementing improved practice.

A. Organization of Public Education

All authority exercised by agencies and individuals in the public schools has its origin in state legislatures. State departments of education, county school departments, and local districts are agents of the legislature, each assigned specific responsibilities in support of the state educational enterprises.

In order for these enterprises to operate efficiently, three broad functions must be carried out: policy determination, coordination, and operation. Chart 3.1 shows the distribution of these functions among the three levels of the California educational system. This distribution may be considered typical of many states.

Policy determination and operation are commonly understood terms. Coordination involves providing advice and assistance to district personnel above the level of teachers (i.e., administrators, curriculum specialists, and school board members) for the purpose of improving the district's instructional programs. Coordination may be considered a "quality control" function which, if successful, provides continuous improvement in the product on the operating level. In general, coordination consists of two tasks: (1) equalizing educational opportunity across the state by focusing special assistance on small, poor or otherwise laggard school districts in order to bring their instructional program closer to the state average, and (2) encouraging and assisting the total state system of public education to continuously evaluate and adopt instructional improvements.

The decision to modify instruction, however, rests with the legislature and the districts. Coordinating agencies (state department of education and county school departments) cannot impose instructional improvements, but can work to encourage and facilitate the adoption of such improvements. Thus, state agencies and county school departments employ subject level or area specialists who provide information to district personnel. The state or county curriculum specialist may not always supply this information personally, but he may provide a mechanism (workshops, curriculum committees, etc.) through which district personnel can acquire information. The decision to adopt a change, as well as the adaptation of information and its transmission to teachers and other district personnel, is the responsibility of the district board, administrators, and district curriculum specialists. Direct contact between county and state curriculum specialists and

CHART 3.1

DISTRIBUTION OF BROAD INSTRUCTIONAL FUNCTIONS AMONG LEVELS OF CALIFORNIA STATE SYSTEM OF PUBLIC INSTRUCTION

FUNCTION / LEVEL	POLICY	COORDINATION	OPERATION
State Legislature	Plenary; subject only to constitutional restriction.	None.	None.
State Department (State Board) of Education	Limited (e.g., elementary textbook selection).	Responsibility for promoting equal educational opportunity and improvement of instruction in school districts across state.	Severely limited (e.g., State School for the Blind).
County School Departments	None.	Responsibility for promoting equal educational opportunity and improvement of instruction in school districts of the county.	May operate special schools and classes (e.g., physically handicapped, wards of juvenile court).
School Districts	Limited to some operational activities.	None.	Primary responsibility for operating all schools and classes.

teachers is usually limited to those occasions when a teacher has been appointed to serve as the district's curriculum representative to some coordination activity.

The quality of the coordination service varies widely among counties and districts. Since no district is required to accept the service and since there are few standards for determining its scope, many districts receive little or no useful information about instructional innovations from county or state departments of education.

The distribution of functions among the levels of the state educational system means that a school district's decision to adopt an improved instructional practice may require the approval (policy decision) of the state legislature and may be affected, to some degree, by support from county school departments and/or the state department of education.

The nature of public education also affects the introduction of instructional improvement. Authority, as well as resources, for a district to make a change may exist; the county school department and state department of education may support and encourage the change; but unless the community approves, no change will occur.

Several recent trends which affect the introduction of instructional innovation should be noted.

1. Legislative Mandates

Recent years have brought a shift in the nature of policy decisions made by state legislatures. Where once such decisions were largely restrictive ("Thou shalt not. . . .") or inclined to set general minimum standards of operation, recent legislative policy decisions have mandated, or encouraged through special funding, the introduction of specific content and methods of instruction. This has the effect of forcing innovation at the operating level. Most observers agree that this activity will continue to increase.

It is doubtful, however, that these mandates create conditions for meaningful improvement of instruction. Where a local community and school district professional staff are opposed to the legislative mandate, *pro forma* compliance has resulted without substantial effect upon what pupils learn. On the other hand, where a community and staff have been committed to an instructional improvement, it has been introduced prior to, or often in spite of, legislative action.

2. Teacher Organizations

Recent legislative enactments in several states have given teachers' organizations the authority to negotiate ("meet and confer") directly with district governing boards on matters involving instructional improvements. This, some observers feel, will insert a significant element into the decision-making process. It is argued that teachers will be able to bypass the administrative and supervisory "gate-keepers" and deal directly with the policy makers (governing boards). Experience to date, however, does not support this belief. Negotiations between teacher groups and governing boards have been almost exclusively concerned with topics which, although they may include some element of instructional improvement, are primarily concerned with teacher welfare--salaries, work load, nonwage benefits, personnel policies, etc. No examples have been reported of teacher groups negotiating with governing boards to adopt instructional improvements that would result, for example, in increased work load or additional study or retraining for teachers.

On the other hand, there have always been individual teacher and group efforts to develop new instructional improvements. Where such improvements required a policy decision for implementation, they have met the same constraints which proposals from any other person or group have met. Where such innovations required teacher organization support, the support has generally been withheld unless the element of teacher welfare was present.

During the next decade, the role of professional organizations will probably continue to be one of supplying teachers with welfare-oriented information and services and of lobbying for teacher welfare measures at the policy decision level. Direct organizational involvement in decisions affecting instructional innovation at the district level seems unlikely.

3. Federal Government - U. S. Office of Education

With the advent of the National Defense Education Act, the Elementary and Secondary Education Act, the Vocational Education Act, and others, the impact of the federal government upon instructional practices has increased dramatically. The availability of substantial amounts of federal money for districts which meet criteria established by Congress and the U. S. Office of Education has led to federal direction of an increasing, but still small, portion of the nation's educational effort. The trend seems to be toward greater federal involvement in instructional improvement.

Organization of Education - Summary

Public education is characterized by a diffusion of decision-making authority. At the operational level, such authority is shared by the local district and the state legislature. Information and assistance on decision making and policy implementation are provided by county school departments and state departments of education. Unfavorable public and professional attitudes toward proposed changes, particularly at the district level, can impose an important constraint upon acceptance of innovation.

Mandates from state legislatures and opportunities for obtaining additional state and federal funds to support specific instructional practices are also having a greater impact upon the operational level.

The effects on instructional practice of innovations initiated by teachers and teacher associations will remain at about current levels. Professional associations will continue to provide information exchange and lobbying services for their memberships on matters affecting teacher welfare.

B. Improvement in Instructional Practice

As used here, instructional improvement and innovation mean those changes at the operating level (district, school, or classroom) which require the approval of, or contact with, another agent or level. We do not include here those decisions which the teacher makes in his day-to-day teaching. Although vital to the quality of instruction, such decisions are routine. Our concern is with those decisions which are non-routine and require the institution of new practices and procedures.

Listed below in Chart 3.2 are the general conditions which must exist for instructional improvement to take place.

CHART 3.2

Conditions Required for Instructional Improvement

Condition	Description
a. Perception of Need to Change	Problem has been identified; individual or group has requested or demanded improvement; change is required
b. Opportunity (Approval)	Policy level (approval agencies) will permit change
c. Solution Known	Probable method of improvement is (or alternatives are) identified
d. Resources	Time, staff, space, materials and funds are available to support initiation and maintenance.

Each of these conditions creates unique information requirements for the system:

1. Perception of Need to Change

Are the district's goals realistic?

How do these goals compare to goals of other districts?

What evaluative instruments are available?

To what degree is the district meeting its goals?

How well are other districts meeting their goals?

Are there new processes, techniques and materials being adopted elsewhere which might affect these goals?

2. Opportunity (Approval) to Change

What are the legal restrictions, if any?

What is the attitude of the school board and community?

What similar changes have taken place elsewhere and with what results?

3. Solution(s) Known

What research has been conducted in this problem area and with what results?

What development has taken place?

Which districts have applied solutions?

What were the results?

How unique is our problem?

Can experience in other districts be adapted to our situation?

4. Resources

What does the proposed solution cost to initiate and maintain?

What are the space, staff, material, training requirements, etc?

What resources can be made available?

What additional resources can be obtained?

Improvement in Instructional Practice - Summary

Improving instruction requires that the operating level (teacher, school, or district) make some outside contact for the purpose of obtaining information. This information is required (1) to help operating personnel perceive the need to change, (2) to encourage policy groups to grant approval, (3) to describe alternative solutions, and (4) to define the resources required to implement the instructional innovation.

C. Types of Information

The operating level in the public education system receives various types of information on solutions to problems. Chart 3.3 describes those which are presently available.

General Information is often unsolicited. It pours into the operating level in varying formats from widely diverse sources, and is rarely complete or easily used. It does, however, serve an important stimulatory function. In a general, diffuse way, practitioners are kept informed of "what's new," of problems faced by other practitioners, of solutions applied, of new developments, and of the successes and failures of their peers. When this information is received, the practitioner relates it to his personal situation and begins to ask such questions as: "Am I meeting my goals?"; "Could this do something for me?"; "Could this happen to me?", etc. This process often stimulates a search for other types of information.

The other types of information classified in Chart 3.3 require that the practitioner initiate a request. The particular type requested is determined by these factors: the user's position, his knowledge of the field in which he is making an inquiry, and the degree to which he is committed to implementing a probable solution. In each case, the user has a "need to change" and is seeking a solution.

Focused Information is best described as an initial search through all the information available. The practitioner has identified his problem area, but is largely unaware of the range of information or the sources available to him. His inquiry is in the nature of: "Tell me what's new in ________?" or "What are other people doing about ________?" or "Who has done something recently about ________?" This type of information rarely results in action. It is neither specific nor usually detailed enough to guide an adequate response. It is useful, however, as a survey device to narrow the field for further inquiry.

Information systems such as the Educational Resources Information Center (ERIC), and the School Research Information Service (SRIS), professional education libraries, the Education Index, Clearinghouse

CHART 3.3

INFORMATION SOURCES - BY TYPE

INFORMATION TYPE	MEDIA	FUNCTION	USER
General "What's new?"	Received, sometimes unsolicited, through word-of-mouth, journals, newsletters, professional meetings, general communication media, college courses, inservice training programs, commercial sources, etc.	Stimulates interest in changing.	Teachers Specialists Administrators Policy Makers
Focused "What's new in __________?"	Requested from: E.P.I.E., ERIC, SRIS, library collections, bibliographic listings, clearinghouse reports, etc.	Provides information in broad area defined by user.	Specialists Administrators
Specific "Give me everything on__________."	Requested from: Research libraries, information centers.	Provides all available information on a specific subject defined by user.	Specialists Administrators
Interpreted "What does ________ mean?"	Requested from: Consultants (Private, County School Department or State Department of Education).	Provides interpreted and evaluated information adapted to the needs of the user.	Teachers Specialists Administrators Policy Makers

Reports, listings of abstracts, and the like are all sources of focused information.

Specific Information is requested when the inquirer has an initial knowledge of the field or when a previous request to a focused information source has helped to narrow his field of inquiry.

The request for specific information may be expressed in the form of "Get me everything on __________." or "I want a copy of that study by _________." The seeker of such information has progressed toward a general solution. He is attempting to narrow the solution area and to make some judgments about the relevance, the opportunity for approval, and the costs of instituting a solution in his district.

Interpreted Information emerges when all relevant information on a particular area has been collected, evaluated, and interpreted. This type of information must be available before a valid solution can be designed.

At the present time, little evaluated and interpreted information is available. Users who are committed to innovation usually turn to a consultant for advice. The consultant may be a college or university faculty member, a practitioner in another district which has recently adopted the same or a similar innovation, or a curriculum specialist from the district office, county school department, or state department of education.

D. Derivation of Information

Information about innovative instructional practice usually is derived from formal research and development and innovative operations.

R and D Activities, usually conducted by members of college and university staffs, have as their primary purpose the evaluation of a process or practice not generally accepted as proven.

Information about these activities may become available at any one of several stages, described by Robert Gagné as:

Initial Plan

Proposal

Program Plan

Progress Report

Research Report

Abstract

Evaluative Report

Interpretive Summary

Handbook.

The information available at any given stage is helpful to only a narrow segment of users. At the present time, information systems provide general, focused, and specific information about all stages of research and development, but in varying degrees of responsiveness to the immediate need of the user. Many researchers believe that information on research activities should not be made generally available to users before the Abstract (or Evaluative Report) stage. They argue that, prior to this stage, information is tentative and directed to answering the research problem; its results cannot be applied to instructional operations. Information about early stages of research, they point out, is of real use only to other researchers.

Users, on the other hand, express keen interest in finding out what is on-going in research and complain that little current information is available. (Their complaint may be a result of a lack of interpretive summaries. It may also indicate that available summaries are inadequate, since users complain that too much of the research is not "useful" or is "in the wrong format.")

Innovative Operations, as applied here, refer to those activities at the operation level which are new to some or many practitioners, but which are not designed primarily to provide or test new knowledge. These operations are on-going instructional activities, instituted to solve a particular problem. They may either be based upon or adapted from research findings or other innovative practices or have a completely subjective justification. Innovative operations are often evaluated objectively, but usually with far less rigor than R and D activities.

Although general, focused, and specific information about innovative operations is available, district personnel generally think that it is not easily acquired. Useful information about known innovative practices often seems difficult to obtain. Users also feel that they know nothing about other available information on innovations.

Originators of information, then, are the researchers, who develop and test new knowledge about instructional practice, and the practitioners, who operate innovatively. Information about their activities is not adequately conveyed to users.

E. Users of Information

Users of information are those persons at the operating level who require information in order to institute instructional innovation. Not included in this definition, for example, is the researcher who requires information to perform his research function.

It is not possible to designate information users by job title because of wide variation in school district size and staffing patterns, non-uniformity in job titles, and differing degrees of emphasis districts give to instructional innovation. Four distinct functions are, however, visible in every school district. These may be performed by persons having various job titles. Often, one person may be involved in more than one of these four functions:

1. Teaching

2. Curriculum Development

3. Administration

4. Policy Determination.

Chart 3.4 lists the more common job titles in the education profession and indicates the range of titles that are most often assigned to persons who perform the functions listed above.

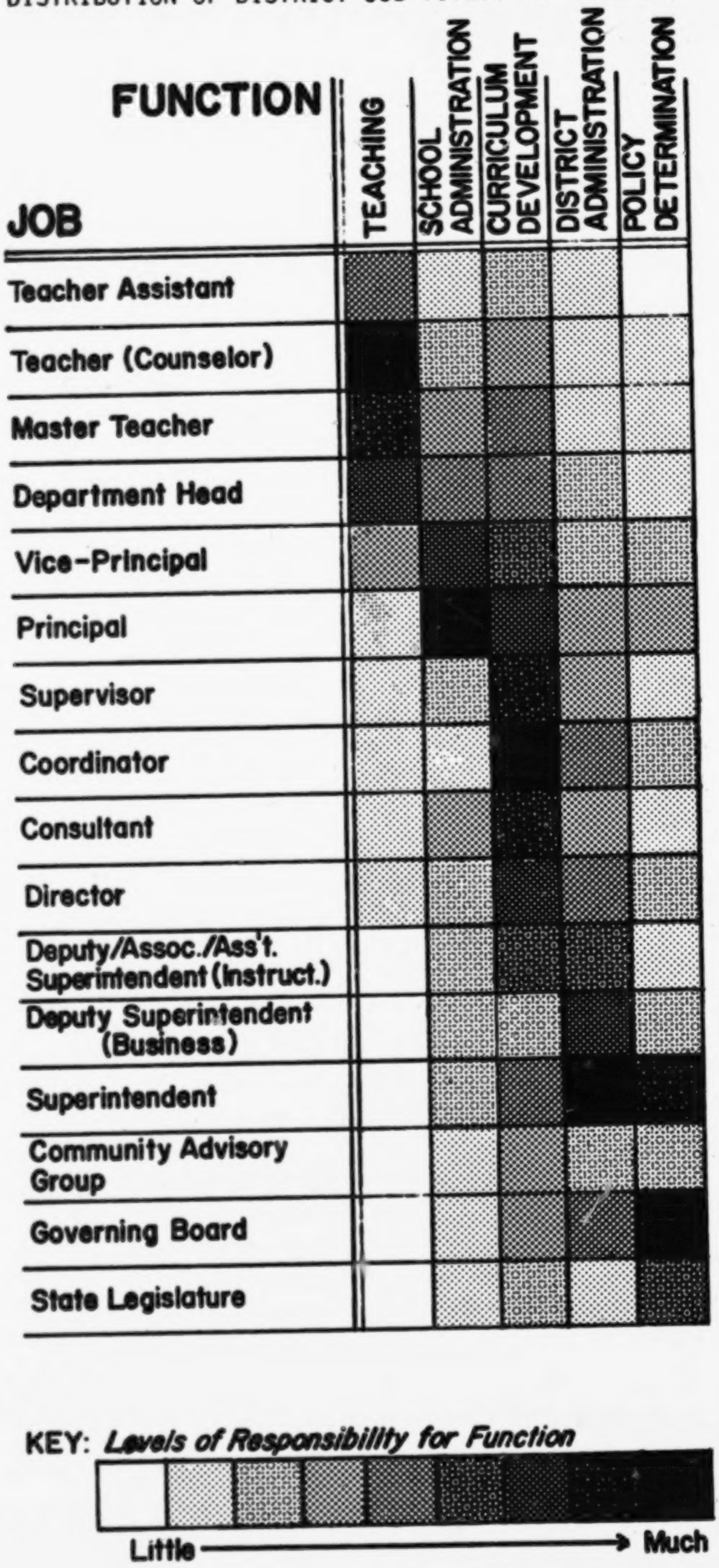
The teaching function is, of course, performed primarily by teachers; but department heads, vice-principals, principals, and coordinators may teach one or more classes. Teachers, on the other hand, may have specified administrative and curriculum development tasks.

The curriculum development function covers the broadest range of job titles. Persons performing this function interpret and adapt innovations to meet local needs and are potentially heavy users of the information system. Curriculum development is the primary responsibility of the coordinators/consultants/supervisors who are concerned with instructional improvement. An axiom in education states, however, that "curriculum development is everybody's job."

The administrative function includes two roles--school and district administration--which are melded in practice through various internal management devices, such as administrative cabinets, etc. In some districts, the coordinator/consultant/supervisor group may perform administrative duties, although this is generally regarded as poor practice. Directors and/or assistant superintendents link the curriculum development and the administrative functions.

Policy determination is the responsibility of the district governing board and the state legislature. At the present time, the administrative group has the largest impact upon the policy makers, although recent legislation proposes to give teachers and curriculum specialists a more immediate and greater impact upon local governing board policy decisions. Policies are, of course, effected by personnel assigned to other functions.

Each function plays a part in instructional innovation and has unique information demands. Curriculum development utilizes information on the process of the innovations and their personnel needs. In general, Chart 3.4 DISTRIBUTION OF DISTRICT JOB TITLES BY FUNCTION



teaching requires that information on innovations be processed and then adapted to classroom tasks. Administration demands information relevant to the resource and management requirements of innovations and to their effect upon teachers and policy groups. Policy determination requires information which interprets resource needs and results in broad terms. Policy groups are concerned far less with the procedures for instituting innovations than are persons performing other functions.

F. Sources of Information

The number of sources of information on innovative instructional practices cannot even be estimated at the present time. Information now flows into the system from a wide variety of sources, and thus differs in degree of completeness, accuracy, credibility, validity and in processing requirements. The information input generally takes two forms: (1) individual items or documents and (2) human memory and verbalization.

Several categories of subsystems operate upon the original information to make the input more usable.

Indices. Indexed lists of educational information are available, such as the Education Index and bibliographic indices published by government agencies, professional associations and commercial groups. Common complaints about such indices are the inadequacy of subject heading or other categorization schemes, the lack of descriptive material and the time lag in production.

Libraries. Professional libraries, usually district or county curriculum and university libraries, are generally available to most individuals. The users of this subsystem complain, however, that the collections are incomplete and not designed for effective use. The collections in most libraries are built and organized on the basis of specific user requests rather than on an assessment of needs and anticipation of requests for topics of immediate or growing interest. In addition, libraries are not organized primarily to collect R and D information. (Although librarians would like to do this, they state that the resources are not available to them.)

Information Services. Several information services, national or local in scope, either are being planned or have begun operations. The Educational Resources Information Center (ERIC) and the School Research Information Service (SRIS) of Phi Delta Kappa are examples. These services will provide focused and specific information upon request in the form of either bibliographic lists of stored data or complete documents.

ERIC, a national information service managed by the U. S. Office of Education, has established eighteen clearinghouses, each assigned to a particular field or subject. At some future date, the clearinghouses plan to prepare resumes in special areas.

SRIS proposes to serve school districts by collecting, indexing, and storing for retrieval reports of innovative practices in public schools. Hopefully, the ERIC data file will be cross-indexed to the SRIS file.

Problems have been encountered by users of these information services for the following reasons:

1. Small size of data base (e.g., in August, 1967, ERIC had only about 2,500 documents available)

2. Differences in methods of collecting information

3. Lack of critical evaluation of input material

4. Lack of systematic feedback from user on the value of the information and/or services.

5. Lack of interpretive or evaluative summaries

6. Lack of personalized service, i.e., there is no dialogue with the user to help him define or refine his problem.

Personal Interaction. The most commonly used and, presently, the most valuable information service, is the interaction of people at conferences, workshops or meetings of various kinds, and on-the-job discussions. This is a highly subjective subsystem, but one which users report yields high credibility.

Personal interaction, however, tends to develop and reinforce a narrow "closed loop" information system which insulates the user from much of the available relevant information. Its information capacity is, of course, limited.

Organizations. Professional organizations, government agencies, and other formalized groups (including private industry) provide information services in the normal course of their operations. Nearly all groups publish some type of document, ranging from newsletters or journals to reports of conference proceedings, which may be accessible; however, the value of the content, in terms of the validity and timeliness of the reports, is often questioned.

Users point out that much R and D information relevant to instructional innovation appears in documents produced by associations related to other disciplines, such as psychology, sociology, medicine, and anthropology. This material, and similarly, information generated by private industry, is not readily available to the educator.

G. Content of Information

Research and development in education occurs in the following conventional subject areas:

1. Definition of Objectives
2. Curriculum
3. Instructional Methods
4. Guidance and Counseling
5. Teacher Training
6. Assessment of Student Capability
7. Assessment of Student Performance
8. School Administration
9. School Financing.

Since these areas are related to and derived from the purposes rather than the methods of education, research findings must apply not to day-to-day operations, but to periodic decisions for change that are made when new objectives are established or when the existing operations fail to achieve established objectives.

H. Developments

The following developments can be expected to exert an effect upon the operation of any information system serving instructional innovation:

1. National Information Service

Present plans for the development of ERIC should result in its emergence as the primary national service producing educational research and development information. No other proposed or developing national service has comparable organizational support, financial resources, or access to R and D information.

The information content of ERIC will include abstracts and reports of federally sponsored R and D projects from the funded proposal through final report stages, as well as abstracts and reports of R and D activity supported by major foundations. Cross-indexing to other national information services hopefully will be available.

The number of ERIC clearinghouses will probably expand from the present eighteen to twenty or more. These clearinghouses will prepare summaries of relevant research by subject or area of interest and will distribute them through ERIC. Although ERIC will not include journal literature and will not provide interpretive and evaluative reports of R and D, the service may contain bibliographic lists of such documents maintained in other information service files. ERIC may also contain bibliographies of curriculum materials, such as manuals and handbooks, maintained in other collections.

2. State Information Services

Both the California and Nevada State Departments of Education now recognize the need to improve the dissemination of information on instructional innovation. Such recognition should result in the establishment of more formalized state-wide information services, probably in the ERIC format. The information content of these state services, however, will emphasize instructional materials (guides, manuals, handbooks) developed by state and local educational agencies. Bibliographies of these collections may appear in ERIC.

Specialized state-wide information systems serving narrow bands of users, such as special education personnel, vocational educators, or PACE Center personnel, will probably become more formalized as public education becomes more specialized. Cross-indexing of these specialized services to a general, state-wide service will be a continuing problem.

3. Role of School Personnel

The roles of personnel at the operating level continue to change in response to changing conditions both in the profession and in society.

Teachers are currently seeking a greater role in the process of instructional decision making. While we believe that teacher organizations will not assume a major role in decision making within the next ten years, the number of teachers seeking to effect instructional policy and possessing the expertise to do so will continue to increase. This number, however, will probably remain a small portion of the total teaching force.

School principals, it seems clear, are now largely uninvolved in the instructional innovation process. They will probably move further into the administrative/management areas and, as schools grow larger and become more specialized, will become less and less instructional leaders.

Curriculum specialists will probably be much less concerned with locally initiated innovation and supervision (i.e., evaluation of individual teachers) and more involved in the local adaptation of major curriculum innovations originating elsewhere.

The presence of the curriculum specialist in local districts is becoming less common as school districts grow and reorganize. This reflects, in part, the greater demand for administrative roles in larger districts and, in part, the allocation of greater proportions of district budgets to teacher salaries and other benefits.

The reduction in the number of curriculum specialists at the district level is occurring at a time when there is an increased demand for interpreting and evaluating instructional innovation--a task which such specialists are uniquely qualified to perform. This situation may well place greater demands upon state and county curriculum specialists. (The California Teachers Association proposes to make consultant services available to local teachers' associations to help them develop and implement instructional improvements. This proposal may portend the employment of curriculum specialists by teacher organizations rather than districts. In any case, it supports the need for the curriculum specialist.)

4. Private Industry

We may expect to find increasing development of "instructional packages" prepared by private industry for sale to the schools. These packages will probably provide information on subject matter and recommended methods or procedures and include instructional materials and equipment.

I. Summary

Effectively implementing innovation in today's elementary and secondary schools requires the cooperation of many levels within the educational system. Initially, research and development is supported and/or performed by universities, foundations and some school districts. The R and D results, however, are seldom in a form that can be applied directly in the schools; they must be summarized, interpreted, and translated into usable forms. Assistance in adapting research results to the teaching function, however, is imperfectly rendered by curriculum specialists at the district, county and state levels. Furthermore, the curriculum specialist is becoming a less common feature in the local school district, while his function is becoming more important.

In the schools, the decision to adopt improved practices depends upon the perception of the need for change by teachers, administrators, and approving agencies (local governing board and/or state legislature). The approval of change is often conditioned by the availability of resources over which the operating agency may have little control. At the present time the administrative group has the largest influence upon policy decisions, although teachers are striving for a greater impact upon local governing board decision making.

The information requirements of the several groups participating in the change process vary. The present information network serving public education provides great masses of information to all participants. Present subsystems, many of an informal nature, serve researchers and administrators moderately well. The new subsystems and services planned or just beginning will improve information not only for researchers and administrators, but also for curriculum specialists.

The most serious failing of the present information system, however, is the almost total absence of interpreted and evaluated information available and useful to classroom teachers.

IV. MODEL SYSTEM REQUIREMENTS

A. Introduction

The following description of a theoretical system for disseminating information on improved classroom teaching is intended to represent an idealized situation in which all reasonable needs of the users are satisfied without regard to cost, technology or manpower availability. The theoretical system is presented in terms of the functions required of the various system components. In a subsequent section of this report, various alternative systems, more feasible in terms of present-day constraints, will also be described in terms of functions. A comparison may thus be made of the "possible" with the "desirable" on the basis of function alone. This analysis and comparison by function is intended to avoid as much as possible any bias toward a particular type of available hardware or present mode of operation of an information system.

"Information system" or "system," as used in this report, refers to the complex of all functions involved in the process of collecting, developing and producing in final form information on innovations in elementary and secondary education. The term also covers dissemination of this information and its application to classroom situations.

As defined above, a system need not, of course, have all its component parts or functions co-located to operate properly. It is assumed in this case that many parts of this system will be dispersed. The research activities on which the system will depend for a large part of its information may be performed in many different locations. The information files themselves may or may not exist as a single grouped entity. They may be stored in one large central area or in several separate regional or topical files from which their purpose could be served equally well.

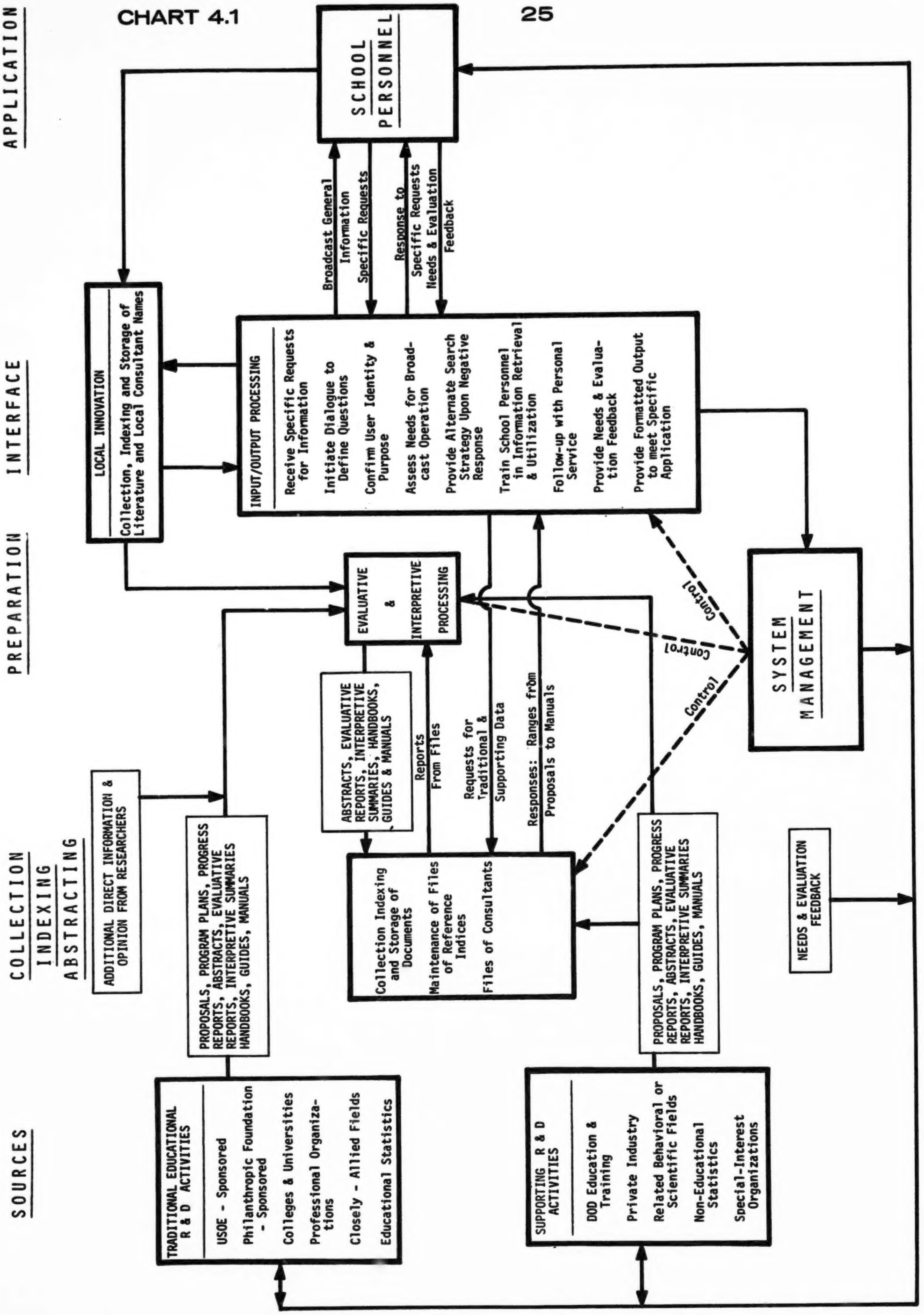
B. Functional Description

A functional block diagram of the theoretical system is presented in Chart 4.1. The various detailed functions depicted in this figure can be grouped into the following major classes.

1. Collection of Information

Tangible information on instructional methods exists largely as formal and informal reports, theses and dissertations, and journal articles. These describe, with varying degrees of quality, the bases, methods, and results of research and, in some cases, relate experience in application to classroom situations. At the present time, this information resides in a number of different places: the libraries of colleges and universities; collections of various local, state, and federal

CHART 4.1


SOURCES
COLLECTION
INDEXING
ABSTRACTING
PREPARATION
INTERFACE
APPLICATION
SCHOOL PERSONNEL
Broadcast General Information
Specific Requests
Response to Specific Requests
Needs & Evaluation Feedback
LOCAL INNOVATION
Collection, Indexing and Storage of Literature and Local Consultant Names
INPUT/OUTPUT PROCESSING
Receive Specific Requests for Information
Initiate Dialogue to Define Questions
Confirm User Identity & Purpose
Assess Needs for Broadcast Operation
Provide Alternate Search Strategy Upon Negative Response
Train School Personnel in Information Retrieval & Utilization
Follow-up with Personal Service
Provide Needs & Evaluation Feedback
Provide Formatted Output to meet Specific Application
EVALUATIVE & INTERPRETIVE PROCESSING
Control
Control
Control
SYSTEM MANAGEMENT
ADDITIONAL DIRECT INFORMATION & OPINION FROM RESEARCHERS
PROPOSALS, PROGRAM PLANS, PROGRESS REPORTS, ABSTRACTS, EVALUATIVE REPORTS, INTERPRETIVE SUMMARIES HANDBOOKS, GUIDES, MANUALS
ABSTRACTS, EVALUATIVE REPORTS, INTERPRETIVE SUMMARIES, HANDBOOKS, GUIDES & MANUALS
Reports From Files
Requests for Traditional & Supporting Data
Responses: Ranges from Proposals to Manuals
Collection Indexing and Storage of Documents
Maintenance of Files of Reference Indices
Files of Consultants
PROPOSALS, PROGRAM PLANS, PROGRESS REPORTS, ABSTRACTS, EVALUATIVE REPORTS, INTERPRETIVE SUMMARIES HANDBOOKS, GUIDES, MANUALS
NEEDS & EVALUATION FEEDBACK
TRADITIONAL EDUCATIONAL R & D ACTIVITIES
USOE - Sponsored
Philanthropic Foundation - Sponsored
Colleges & Universities
Professional Organizations
Closely - Allied Fields
Educational Statistics
SUPPORTING R & D ACTIVITIES
DOD Education & Training
Private Industry
Related Behavioral or Scientific Fields
Non-Educational Statistics
Special-Interest Organizations

government agencies; transactions and journals of professional societies; records of professional meetings; and personal collections of educators and others.

The function of collecting information for inclusion in a system has three sub-functions: (a) location of information, (b) evaluation in terms of pertinence and suitability, and (c) acquisition for use.

a. Location of information requires knowledge of and access to a large number of sources which may be widely dispersed, since education touches on various other disciplines, particularly the social/psychological fields. The following are typical of possible sources:

(1) Reference materials in general and specialized libraries

(2) Prepared abstracts in specialized fields

(3) Special-purpose indices (Education Index, for example)

(4) Indices and resources of professional societies

(5) Contacts with individual workers in the required field of specialization

(6) Preliminary information on research work in process (progress reports, for example)

(7) Proceedings from professional society and special-purpose meetings

(8) Journals and other publications of professional organizations

(9) Indices of government-sponsored projects

(10) Sources of statistical data--government and other.

A continuing effort to develop knowledge of the availability of such sources, as well as thorough familiarity with their content, credibility, and methods of use, is essential to the sub-function of information location.

b. Operating an information system requires a continuing effort to prevent trivial and non-pertinent information from entering the system. People experienced in using present sources generally agree that much of the readily available information is either unsuitable to their needs, too poorly documented to be of any use, or unacceptable because research work was not performed carefully or thoroughly enough. Because of the volume of research and other material being generated, as well as the need for school personnel to receive requested material in usable form, a screening function must be included in the collection process.

Within the theoretical system, a "development" group, composed of experts in the particular area of information being considered, would study the quality and pertinence of material proposed for inclusion in the system files. They would use standards for documentation and research methods established with the concurrence of appropriate members of the professional community. The "development" group would thus perform a function similar to one now performed by editorial committees in accepting papers for presentation at conferences or publication in journals. For example, a research report on a topic of interest to classroom teachers or curriculum coordinators might be accepted by the group only if it meets the standards on experiment design and validation and includes a clear abstract and interpretive summary. The value of the work would then be apparent.

c. After a document has been determined suitable for inclusion in the system, its acquisition begins. For the most part, acquisition is a mechanical process whose form will depend greatly on the form taken by the system files.

If all the system documents are to be stored in a central file, then acquisition means obtaining one or more complete copies of the document. In this case, since the fundamental reason for placing a document in the file is to facilitate its duplication and dissemination, the copyright status and terms of each acquired document must be clearly understood and observed.

If the central file consists only of references to sources of information, then acquisition becomes the simpler process of adding a record to the files with appropriate source information and a suitable description. In such a case, there would probably be no need for concern over copyrights at the time data entered the system.

2. Preparation, Indexing and Maintenance of Files

A primary purpose of the system is to acquaint teachers with material which they can then apply to their work. To satisfy their need, the system should contain short, printed abstracts of each document suitable for quick review. Significant differences in background, training, and interests between teachers and researchers, however, will cause difficulty for the teachers in fully understanding and properly applying many of the reports. An interpretive function is therefore clearly needed. Interpretation and synthesis could probably be combined whenever a large amount of information exists for a topic area. In this case, the teacher's need would more likely be for an overview or synopsis of what has been done by several researchers, rather than for an explanation of what has been done by one or two.

The abstracting and interpretive functions could be performed by the "development" group if they are to be considered the "engineers" of the system. In other words, they would assume the role of intermediary between pure research and application, functioning similarly to engineers who serve the economic community.

The existing communication gap between researchers and teachers could also be narrowed by making researchers aware of the need for effective communication with the users of their product. A system of rewards could be developed for successful communication.

The need for indexing the collection requires no explanation. This system would probably use several other sources as part of its files. If at all possible, therefore, common indexing procedures should be developed.

File maintenance would include mechanical upkeep of the materials, replenishment of stock, and supervision of usage and other records.

3. Interface with Users of Information

The users of the information system are those people concerned in any way with decisions to introduce innovations in educational methods. In general, people at or close to the teaching level can be expected to have the greatest need for material provided by the system. For certain purposes, however, particularly advisory and informational, school personnel at all levels will make demands upon the system. Under some conditions, even lay groups such as school boards and parents' organizations may find the information in the files valuable.

The interface function encompasses all actions needed to furnish a satisfactory response to a request for information. Normally, the user group will submit rather general, poorly defined requests which cannot be used to pinpoint specific information in the files. A very important part of the interface function, and one which will heavily affect user acceptance of the system, is assistance in problem definition and explanation of general system capabilities. This service will enable users to learn how to communicate with the system and take full advantage of the accessible sources of information.

In an ideal situation, the user would be able to establish a quasi-personal relationship with the system so that response to his questions would be attuned to the role he identifies for himself in requesting information. The system itself would be designed to furnish responses and to ask pertinent questions on either a "check-list" basis or on a more sophisticated level. This procedure would (1) establish specific information needs; (2) offer alternative search strategies if required; (3) confirm, when it becomes apparent, that a request cannot be filled; (4) in the case of successful searches, provide an estimate of the volume and the cost of furnishing the requested data; and (5) offer an opportunity for the requester to specify the format of the data to be supplied. The availability of various output formats for the latter purpose would permit the user to make a selection according to his interests. The design philosophy of the interface, then, is to provide an automated equivalent of an intelligent and helpful librarian who is well acquainted with the available information, alternative sources, and typical needs of different user classes.

An individual could pose his questions to the system by typing them on some kind of keyboard. The system would then respond as to data availability, cost, search strategies, formats, etc., by means of a cathode ray tube (CRT) display or a teleprinter. The device should be capable of displaying an abstract of any document on file in the system within a reasonable console-operation time, up to one minute. Ideally, a hard copy of a complete document would be printed at the user's terminal within ten minutes after his request has been entered.

Another vital sub-function performed at interface is feedback of information on usage volume, types of information required, profiles of the user population, user acceptance, and other indicators of system performance. The System Management function, described later, will use this information in the continuing improvement of system operation.

The interface function includes all input/output subfunctions concerned with dissemination of the information in the system files. Included are such activities as providing hard copies of file documents, furnishing descriptive material and training programs on system usage, maintaining personal liaison to handle special questions outside the scope of the automated facilities, and handling other problems encountered in use of the system.

4. Application of Information to Classroom Problems

The end use of the information on innovative practices--its practical application to improving effectiveness of classroom teaching--is the most important part of the entire system. Curriculum specialists, personnel concerned with specifics on potential improvements, and individual teachers who desire access to the system comprise the bulk of the "customers." Unless they are able to use system facilities to learn of improvements in the teaching arts and to select and apply them knowledgeably, the system will rapidly become useless. Because it is important that this user group accept the system, both system management and interested educators must direct continuing attention to all activities which will ensure a healthy level of participation. Although other activities will undoubtedly become evident to these personnel with additional experience, some initial possibilities are suggested:

a. Preparation and release (to news media, professional organizations, and others) of "public relations" material which describes the purpose and scope of the system and, wherever possible, gives specific examples of its effectiveness.

b. Conduct of workshops, institutes, and other informational sessions to acquaint potential users with the purposes of the system and its value to their work, as well as to train them in its use.

c. Demonstration of the system, to emphasize the value of knowing about on-going educational improvements, for lay groups which exert strong influence on education policies. Directed particularly to school boards, parents' organizations, civic associations, etc., this activity should be exercised with extreme care in order to show benefits which will clearly accrue to members of these groups.

d. Continuing appraisal of the system with the aid of advice from users on its effectiveness.

5. System Management

Although this function is shown as one block in Figure 1, it is not necessary that a single individual or small group perform the total management or control function. In fact, some sub-functions are performed more effectively by various independent individuals who might be called system "contributors," rather than "managers." The following are types of management sub-functions which apply to the theoretical system:

a. Control of system configuration

b. Supervision of user interface activities

c. Coordination of development activities

d. Review of data file status, condition, volume, etc.

e. Review of indexing and abstracting procedures

f. Advice to research organizations on topics for needed research

g. Coordination with users on needs and system effectiveness

h. Staffing and training

i. Advice on staffing to coordinating groups

j. Coordination with school system personnel who determine instructional policies under which the users of the information system perform their teaching function

k. Maintenance of effective public relations

l. Adherence to established operating policies.

V. PRACTICAL SYSTEM CONCEPTS

A. System Constraints

Many forces are acting to prevent the ideal information system described earlier from achieving its potential. Among these are:

1. Inadequate taxonomy of educational R and D information
2. Lack of standards for information products
3. Lack of an established "engineering" function in the educational system
4. Existing information services and interests
5. Unsophisticated user population
6. Differing national and regional interests
7. Lack of system evaluation criteria and methodology
8. Available hardware and software
9. Cost of development and operation
10. Legal sanctions.

The following discussion of these forces attempts to provide a rationale for the selection of practical system concepts in the following sections of this report:

1. Taxonomy of Educational R and D Information. Unfortunately, Gagne's systematic categorization of research areas (Section III D) is not closely followed in practice, so that system sources, files, and indices cannot be optimally constructed and organized. The problem may be due to the lack of a broadly accepted basic theory or body of knowledge from which an orderly structure can be developed. This is a problem common in the behavioral sciences and particularly evident in education, since large-scale R and D activity in this field is relatively new and since the development of a structure seems to be largely a function of time.

This situation causes difficulty in the following areas of information system design: (1) system indexing, (2) identification of directly applicable versus related or allied bodies of data, (3) location of sources for such data, (4) estimates of its utility for various user groups, and (5) decisions about maintaining collections of specific types of data. For example, when someone in an elementary school district directs a question to the system about methods of teaching reading to slow learners, an immediate problem arises with the selection of descriptors. Key words, such as "reading," "language," "instructional methods," "children," "exceptional," "retarded," etc., must be identified. The sources of information must also be located, since there might be important findings in the fields of medicine, psychology, anthropology, biology, engineering or sociology, as well as education. In addition, there might be organizations, ranging from the Department of Defense to the Boy Scouts, whose data could be useful if located.

2. Standardization. Forms of educational R and D data vary both in the quality and kind of reporting effort (e.g., media, format, and comprehensiveness) and in the degree of application of conventional R and D evaluative criteria. The lack of rules in the reporting game makes evaluation of innovative projects extremely difficult and promotes the mechanisms of visitation and personal contact as necessary supplements to report reading.

When a viable information system establishes an index and file structure, it must, to a certain extent, impose standardization on the taxonomy of educational R and D. The product itself does not have as great an effect on standardization, which is an essential requirement of the user. The information system must establish certain format standards for its output and must notify the user when the product supplied deviates from the standard. Of particular relevance to the user are such elements as stage of development of the innovation, research design adopted, evaluation methods used, and bibliography.

Broader considerations of standards, such as quality of the R and D effort, terms and methods required for autoclassification of report subjects, and procedural reporting to central repositories, are responsibilities of the total educational community rather than the information system.

3. The Engineering Function. Since, in most fields, research results are rarely available in forms suitable for application, they must be modified in some way for use in a production process. In education, the classroom teacher is the production worker and the researcher is the developer. However, no formal translation function comparable to the engineering function in science has been established. The information system, therefore, has no organized source of "engineering" data, such as comparative, evaluative and interpretive reports, handbooks, teachers' guides, and manuals. Since working level personnel require these products, the system designed must be responsive to their need.

4. Existing Information Services. It makes little sense to design a system without considering the capabilities of existing organizations concerned with information transfer. All of the functions described in the section on model system requirements are in operation today. However, in some cases they are not performed by the appropriate individuals or groups; in other cases they are not performed efficiently enough to satisfy user requirements. Moreover, the various efforts are not coordinated and made available to the user on a single interface point basis.

At present, so many systems are in the operational and developmental stages that the Far West Laboratory must analyze their approaches and procedures in order to establish appropriate roles in its own concept of an information system. Among the systems that must be considered are:

Educational Resources Information Center (ERIC) - U. S. Office of Education
Educational Products Information Exchange (EPIE) - Institute for Educational Development
School Research Information Service (SRIS) - Phi Delta Kappa
State Department of Education systems
Information System for Vocational Decisions - New England Educational Data System (NEEDS)
National Clearinghouse for Mental Health Information (NCMHI) - National Institute of Mental Health
Science Information Centers Branch - National Institute for Child Health and Development (NICHD)
Defense Documentation Center
Clearinghouse for Federal Scientific and Technical Information (CFSTI) - U. S. Department of Commerce
National Library of Medicine
Science Information Exchange - Smithsonian Institution
National Referral Center for Science and Technology - Library of Congress
Data Banks - National Education Association (NEA), Project TALENT
NEA research summaries
Indexes, e.g., National Information Center for Educational Media, Grant Data Quarterly, Education Index
National, regional, and local libraries.

An examination of the functions performed by existing organizations and their systems should determine whether their objectives and products serve the general interest of school personnel or are of use only to a special interest group.

5. Characteristics of the User Population. Some traits of the user population may serve as system constraints. Since R and D data is not a day-to-day operational need, school personnel are generally not trained to search out or use available information. Both the information product and the system itself must therefore be tailored to the needs and abilities of an unsophisticated user group. Moreover, school personnel are not problem-oriented; that is, they are not skilled in problem formulation, definition, or analysis and, consequently, do not ask the proper questions. A dialogue capability must therefore be included in the system to ensure that the correct question is asked.

School personnel must be motivated to use information services now available. Improved service may require less motivation, although the system should still include some stimulus capability for promoting effective use. School personnel who begin to seek out R and D data have usually experienced some role change which places them in a new position in the innovative or change process. The system content, its media and format, must thus be responsive to the function and role of the user.

6. National vs. Regional Interest. National, regional, community, and classroom goals are evident in the concerns of the educational community. Although it might be difficult, one could theoretically relate the specific behavioral objectives of a mathematics lesson unit, for example, to all of these goals through an "objectives tree."

Educational R and D is funded primarily by organizations with national interests. To ensure proper direction of this funding, there must be communication between those who are concerned with local problems and those who influence the allocation of resources at the national level.

The information system would become aware of divergent interests when it failed to satisfy local user requests because of inadequate educational R and D effort in a particular subject area. A function of the information system, then, should be to effect a feedback mechanism to maintain communication lines between sponsors and users of educational R and D. The existence of disparate local and national viewpoints also implies that indexing systems must accommodate, through cross-indexing, widely varying subject descriptors.

7. System Evaluation. An integral part of a well-designed information system is an assessment and evaluation mechanism for collecting information that will improve the system. This can be achieved by using measurable parameters to describe the system objectives and then periodically testing

accomplishment through measurement and comparison with adopted standards.

In the proposed system, the objectives may be expressed as "improve the quality of education," "improve decision making," "make more information available to school personnel," or "increase the awareness of alternatives." These are rarely measurable with available instruments; however, they must be expressed in measurable terms or system evaluation will be virtually impossible.

8. Available Hardware and Software. Fairly exotic information-handling equipment is presently available, although its application to social systems has not taken place as rapidly as had been estimated. The applications of the more advanced hardware and software have been oriented heavily to military and scientific objectives because of consuming national interest in those areas. The usual reasons for considering the application of automated equipment are (1) volume of data in the system, (2) need to obtain information quickly, or (3) desire for additional processing capability. These are not presently critical factors in the case of educational R and D data. The assumption that development of data processing machinery will surpass central file handling requirements of the information system is therefore a safe one.

In the areas of input/output (I/O) devices, however, information technology is deficient. The emphasis on use of keyboard devices, with attendant training requirements, makes it difficult to meet user demands for "easy" access to a large data base. Further development with CRT/Light Pen devices promises relief in this area; however, the wait for natural language I/O units and question answering systems will be a long one.

9. Cost of Development and Operation. Dollar limitations always operate as constraints on information system developments. In the usual business system application, it is possible to identify present costs of handling data and subsequently to derive the dollar value of a proposed information system. In education, however, it is difficult enough to establish a need for R and D data in terms of the operation of a given school district, let alone to estimate either the cost of providing it in its basic form or the value of improving the system.

One approach to the cost problem would be to assume that the responsibilities for total system operation will be allocated, for some time at least, to a number of different organizations. Each organization would undoubtedly have to evaluate the cost of performing given functions or running a subsystem in terms of the benefits it would receive from the total system.

If all of these organizations were to pool their resources in order to form a national network with integrated files and standardized procedures, they would probably encounter great difficulty in securing general agreement on system design. Altering their individual positions on that issue would require great sacrifice of self-interest on the part of many groups.

10. Legal Constraints. The overwhelming legal problem with information systems in the field of education arises with copyrights. ERIC has tried to obtain permission from major publishers to include their works in the ERIC files. The answers have been emphatically no, and for good reason. Why, for example, should McGraw-Hill provide one copy of a book with the understanding that the book will be reproduced and distributed to hundreds of requesters who might otherwise have purchased it from the publisher? A great deal of discussion will focus on this subject before a solution is reached. Until then, however, system content and distribution of hard copy must take into account existing copyright laws.

State or local restrictions on instructional methods or curriculum might impose some unusual operating constraints on the system. The details of system design can account for such jurisdictional problems, however.

B. Functional Description

This section describes alternative practical performance concepts for each of the five major system functions. It is assumed throughout the following section that the function of system management is vested, at least on the policy and control level, in a single group located in a single place. Although alternative modes of operation will be discussed, none envision diffusion of this group's chartered responsibility and authority.

1. Collection of Information

It would appear that there are few alternatives available for the process of collecting information on sources. An initial, fairly large body of source information is almost immediately available from existing literature, indices, and abstracting services. A first step in the collection process should be to assign personnel to compile this material. Beginning concurrently would be the more difficult, but also more vital, job of contacting research laboratories involved in all areas related to education. Information would be solicited about fields of interest, availability of completed work results, current work, if releasable, and names and qualifications of personnel available to serve as consultants or advisors. Similar support and cooperation would be obtained from private consultants and industrial, commercial, and government research activities.

A slight variation in the method for obtaining such information would be to request assistance from some professional organization to perform the necessary contact and solicitation. This would not be practical in the long run, but might be a good short-term method during the initial organization of the system.

The tangible result of the continuing source location process would be a file which an investigator could use in his search for specific information in response to a defined need.

The process of acquiring information in reply to a defined request can be handled in several ways, depending largely upon how the information is stored. The following is a discussion of possible alternatives:

a. If all documents are stored in a common place, they will probably be maintained in such a space-saving form as microfilm or microfiche. Access to a particular document would involve use of a code to locate the particular portion of the film or fiche desired and then either visual examination of the document record if the requestor is scanning, or production of a photographic print if a copy is needed. Given suitable reproduction equipment, this procedure could fill a well-defined request within twenty to thirty minutes.

b. If some or all of the documents are stored in a location remote from the requestor, access will require remote-handling methods. Delays will be introduced by the handling process--mail, messenger service, queues at the processing facility, etc. Turnaround time from request to delivery of copies of documents can be expected to take from one to ten days. In many cases, delays of this length are not critical, since studies of curriculum material are essentially long-term and usually not undertaken on a "crash" basis. Scanning of abstracts, however, must occur on a "rapid turnaround" basis in order to facilitate the selection of material for in-depth study. This means either that some type of "micro-reader" must be available for use with a micro-form abstract file at the local system terminal or that a file of printed abstracts must be maintained there for inspection purposes.

c. It would seem that a local terminal equipped with microfilm or microfiche abstracts and a suitable number of self-help micro-readers of economical design would satisfy the scanning requirements. Some comments have been made that operating the viewing equipment is difficult for lay users. There is much evidence from experience in other fields, however, that if the equipment is well-designed and if proper training is offered, the users should have no difficulty.

2. Preparation, Indexing, and Maintenance of Files

The following alternatives might be suggested for this function:

a. Preparation of documents for inclusion in the system should cover a review of the source material to ensure that the necessary abstracts and interpretive summaries have been suitably prepared, both in form and content, to satisfy user requirements. If these are not available or readily obtainable, the preparation function should provide them. The following represent alternative preparation activities:

(1) A large, possibly national, activity could be organized to abstract and interpret all innovative material evaluated as pertinent and useful to education. The advantage of this central group alternative is its capability of serving many different educational disciplines, assuming the availability of qualified reviewers in different areas. It might also represent a most effective method in terms of cost.

(2) Specialized reviewing activities, each serving a restricted set of disciplines, could be established, possibly within the framework of existing educational centers. Already implemented to some extent in the ERIC system, this review process offers a practical method that uses existing facilities and qualified personnel at locations which lend themselves to the specialized approach.

(3) Preparing abstracts and interpretive summaries at the source of the research material would afford the least overall cost and seems a very sensible and effective long-term method. A system of rewards for researchers who effectively perform this function does not presently exist. Such a system, along with additional training and changes in attitude toward end-use of research efforts, is essential to make this alternative practical.

b. From the user's point of view, a single, easy-to-use indexing scheme would be desirable. Its scope should be broad and flexible so that new categories may be added at any time. The design should permit the use of efficient machine search methods. Training must also be provided to facilitate understanding and use of the indexing scheme. Attention must be constantly directed to updating descriptive information as the scheme undergoes revisions. A more detailed discussion of alternative indexing methods is not considered pertinent to this study.

c. File maintenance is, for the most part, a clerical or mechanical procedure dependent on the physical configuration of the files. Alternatives must therefore be determined at the discretion of personnel in charge of file upkeep. Establishment of uniform maintenance procedures at all locations would be essential. The enforcement of such procedures would be an important part of the system management responsibility.

3. Interface with Users of Information

Services performed at the interface point consist largely of assisting the user to obtain desired information from the system. Provision of information about the system itself, assistance in formulating requests which better use the classification scheme, help in devising alternate search strategies and in locating other possible sources, and provision of the desired textual material are all general functions of the interface. An important qualification of the interface agent is a thorough knowledge of the system's operational capabilities and resources. He should also have some familiarity with user requirements.

The "idealized" system would be heavily hardware-oriented, that is, the user could address his requests directly to a computer-controlled complex of retrieval equipment and, with the aid of program-controlled search methods, locate the specific reports or portion of a report he desired. A console unit display or rapid printing and delivery of such information would provide him with the necessary data. Some retrieval systems now in existence perform such functions; however, these are extremely expensive and, at least for the present, too advanced for retrieval of educational R and D information.

More practical methods of interface for the system user involve either (1) personal access to records of the material on file or (2) access to an individual familiar with source material and subject matter and able to assist in or perform the required search. The first method involves training the user in details of system operation, making available copies, or at least abstracts, of all documents on file for him to scan, and providing a reproduction service to print permanent copies for further use. This method does not provide the user with much assistance in accumulating knowledge of either file content or alternate search methods. The second method--use of an expert advisor as an interface agent--is generally more successful and probably preferable. Telephone, mail service, or personal contact would permit access to the advisor. One person in a school library, one or several in a district office, or many in an office serving an entire region could fill the role of "advisor." The functions performed would be similar, while the method applied would depend upon funding, anticipated use, and expressed interest.

At the present time, a practical approach to interface might be to synthesize available alternatives--use personal agents to handle special questions and non-personal agents to process routine requests.

4. Application of Information to Classroom Problems

Specifying alternatives for performance of this function is beyond the scope of this study. Methods should be selected at the discretion of school administrators, curriculum developers, and classroom teachers themselves. As these groups progress in their knowledge of and experience in using the system, alternatives will evolve. An alert system management activity will then ensure that these alternatives are documented and made available to all users.

5. System Management

The twelve sub-functions of system management already suggested (Section IV B) describe an "idealized" situation in which management exerts relatively close control or influence over the operation and use of the system. Cost constraints would modify the emphasis placed upon these sub-functions. The probable establishment of a trade-off system would also affect the sub-functions.

Alternatives in the management function itself would therefore be derived from the various combinations of emphasis considered desirable. Alternatives in the form of the management would depend on such factors as location, number and type of interface points and document files, and degree of effort required to cooperate with sources of information not included in the system.

VI. ASSIGNMENT OF ROLES AND FUNCTIONS

The first step in determining practical alternative roles for the Laboratory within the overall information system is to assign functions to those organizations whose present operations or developmental efforts meet identified system requirements.

A. Collection of Information

The identified sub-functions of the collection process--location, evaluation, and acquisition--are being or will be met by organizations now operating on both the national and local levels. The U. S. Office of Education's Division of Information Technology and Dissemination is assuming the dominant national role through operation of the Educational Resources Information Center (ERIC).

ERIC has established eighteen clearinghouses which receive documents in specific subject areas, decide on their applicability for inclusion in the system, and perform cataloging, abstracting and indexing operations. The acquisition function is arranged through central ERIC which now has firm agreements with, among others, the following sources:

All Office of Education-administered programs (Elementary and Secondary Education Act Titles, etc.)
Office of Economic Opportunity
National Science Foundation
Department of Labor - Office of Manpower Policy, Evaluation, and Research
Department of Defense
National Institute of Mental Health (NIMH)
National Institute for Child Health and Development (NICHD)

Experimental efforts are also underway to determine whether or not publishers will consent to the reproduction of selected elements of copyrighted literature which are of interest to the educational community.

The overall objective of ERIC is to become a single source of all information relevant to education. The acquisition function will be steadily expanded to absorb more of the non-traditional sources that are becoming important to the field.

Other organizations performing clearinghouse functions on the national level include:

National Clearinghouse for Mental Health Information, NIMH
Defense Documentation Center
Science Information Centers Branch, NICHD
Clearinghouse for Federal Scientific and Technical Information

Science Information Exchange, Smithsonian Institution
National Referral Center for Science and Technology, Library of Congress
Human Relations Area Files, Inc.
Neurological Information Network

Performing acquisition functions at the subsystem level are the professional organizations which publish journals and sponsor conferences, the total library system, state departments of education, indexing services, and individuals who maintain large collections in their special field of interest. For our purposes, however, the "information system" function of acquisition is accomplished by larger entities who regard these subsystems as sources for the national network.

The acquisition of local information is more difficult. The primary objective of Phi Delta Kappa's (PDK) School Research Information Service is the acquisition of information about school projects, for which PDK intends to use its nationwide network of professional members. Although this effort is just beginning and therefore cannot be evaluated, problems encountered in organizing the acquisition network portend a difficult developmental period. State Departments of Education also have important roles in this function, but they are not organized specifically to process the acquired information for storage and dissemination. Most of the local information now resides within the school districts, but has not been written up in a form suitable for extensive distribution.

In summary, the acquisition function is being performed on the national level by fairly well-organized systems which are just now establishing mechanisms for locating and acquiring documents. One weakness appears to be the evaluation process, which has been affected by the constraints of inadequate taxonomy and lack of standardization. The national systems will tend to be less selective than they should until the quantity and quality of the information necessitate changes in the evaluation philosophy.

There is a clear need to acquire information on local projects. Obviously, a national system is not appropriate for dealing with local materials which may have, at best, regional interest. It might be a waste of effort to develop a system which searches for local projects of national interest and does not duplicate ERIC's method of acquiring materials from ESEA-funded programs.

One of the prime functions for such proposed services as the Bay Area Regional Information Center might therefore be the collection and dissemination of local materials. The state department of education could also execute this function if the information capabilities of its various divisions could be centralized. Collection and dissemination might also be performed by the regional laboratories. In any case, the function merits further study because of its present status as an unfulfilled system requirement.

B. Central Processing Functions

In most instances, the organizations, systems, and services described above also perform the operations necessary to classify and store acquired documents. The existing systems appear to be reasonably adequate in terms of the functional requirements of processing, filing, and storage. However, two areas, indexing and reformulation, exhibit significant weaknesses.

1. Indexing. Evidence of the indexing problems briefly mentioned in the previous section emerged during one of the Task Force sessions. A national network now operating through federally funded Instructional Materials Centers (IMC) provides dissemination services to workers in the field of special education. The ERIC Clearinghouse for this field is the Council for Exceptional Children (CEC) which apparently has only peripheral contact with the IMC network, led by the University of Texas IMC unit. At a recent meeting, leaders in special education adopted a thesaurus of terms written by the Texas staff which was not the same as the one used by CEC. CEC decided to retain the ERIC terminology and thus created a situation in which most workers in the field, by agreement, use standard terms which will not be reflected in the ERIC index. The conflict that is certain to arise will limit ERIC's capability to serve this field.

The solution to the indexing problem would require the establishment of a feedback and review mechanism in all national systems. The mechanism would periodically effect system improvements based on user experiences. ERIC personnel admit that this need exists, but state that, in a limited funding situation, paramount importance must be given to operation and expansion of the system as presently designed.

2. Reformulation. The term "reformulation" means the process of operating on source documents, such as research reports, to produce abstracts, evaluative reports, interpretive summaries, handbooks, and guides in order to meet the needs of school personnel. Whether this is a function of the system or of the sources, as well as where the function belongs within a system, are arguable issues. There is no question, however, that this is a mandatory product requirement for the output phase of the information system and that no one performs this function at present.

ERIC, for example, performs the abstracting function in the clearinghouses. It has recognized the need for interpretive/evaluative literature and requested $500,000 to fund efforts which meet this need. These funds, however, will not necessarily be channeled through the clearinghouses. The research arm of the National Education Association (NEA) has also produced a few summaries. No other systematized attempts have been made to develop new information products. It seems clear, then, that the Laboratory could assume a leading role in this endeavor.

C. Input/Output Functions

The greatest breakdown in existing services occurs in the area of user interface functions. ERIC now states that their system will neither offer nor attempt to offer specialized assistance to school personnel. The clearinghouses will not have, to any large extent, a service capacity for individual requests. The input/output capabilities of the catalogues, indexes, microfiche, and reproduced documents will constitute the ERIC interface with the user. A similar situation exists within other national clearinghouses. They plan to respond to individual requests, but cannot support a dialogue to clarify questions, structure responses to fit individual needs, or provide a feedback loop to evaluate the information system.

A concentrated effort should be initiated in this interface area. Essentially, no ordered activity is even attempting to meet the functional requirements previously identified in the model. This does not mean that no information is reaching school personnel. On the contrary, too much of the wrong kind of information--newsletters, bulletins, journals, flyers, thick research reports, and many abstracts--is easily available. The principal issue is that an unsophisticated user with limited time cannot obtain information in a form suitable for resolving the kinds of problems and decisions for change which he faces.

Different kinds of services, rather than systems, are needed to make R and D information useful to a larger number of school people. (A service of the Community Educational Resources Unit, funded by a National Defense Education Act (NDEA) grant, in San Diego County should be studied as an example of a personalized type of research information service.) The provision of such services, particularly in the area of developing models for the kinds of services needed, is one of the most important information system requirements that the Far West Laboratory can fulfill.

D. Role of the Far West Laboratory

Application of system constraints to the idealized concept of a total educational R and D information system, as well as consideration of existing systems and services, leads to the following major conclusions:

1. Organization and operation of a single system incorporating all sources of information and using one indexing system is not feasible in view of the present taxonomy of educational information and existing organizational interests.

2. Two major functions are not being serviced properly at this time: production of user-oriented information materials (evaluative reports, interpretive summaries, and handbooks) and input/output to provide a dialogue for translating user needs into formalized system language on input and vice versa on output.

The national network should consist of several large and many smaller systems with their own collection and indexing processes. In addition, a subcentral processor is needed to accomplish the input/output functions described in the previous sections, e.g., the interpretation of questions, the use of various systems to collect and organize reports, the evaluation and presentation of data in a form compatible with user needs, etc.

A reasonable approach to the proper organization of these processor functions, in the light of existing user habit patterns and available resources, would be to assign most of them to an information specialist within the school system. Since there is presently a lack of such specialized personnel, the Laboratory could undertake several possible roles: (1) training and support of information specialists in each school district in the region; (2) preparation, production, and distribution of interpretive summaries on subject areas of local interest in a format compatible with user requirements; (3) preparation of an annual review of educational R and D.

1. Training of Information Specialists. In this role, the Laboratory would establish a training program designed to enable selected school personnel to use all information sources (national, regional, and local) to interpret questions and provide evaluated answers, to act as needs assessment sensors, and to provide information interchange on local innovations.

The individual in the school district who most nearly performs the above functions in his existing position would be selected to participate in this training program. The participant might be an assistant superintendent, a curriculum specialist, a data processing coordinator, a research librarian, or in rural areas, a county office representative, principal, or teacher. This specialist must be able to bring his new knowledge and capability directly into the functional operation of the school system without necessitating major organizational change. If the specialist has enough influence, he may recommend or even implement organizational change to facilitate both innovation and the use of R and D data in the innovation process. This, of course, would meet the objective of Component 3 (School Arrangements) of the Laboratory's Communication Program. The training activity would also be related directly to the primary mission of the Laboratory (Inservice Teacher Education) and would thus supply a mechanism for linking the Laboratory's primary and secondary missions.

The training program should incorporate the following:

a. Summary of the state of the art of information technology

b. Thorough introduction to present sources of information in educational R and D:

(1) Who and where these sources are

(2) What their products are

(3) How to use the sources

c. Analysis of these sources by area of special interest and their relation to sources in allied fields

d. Study of cases illustrating how sources are employed to meet user needs properly and how interpretation and evaluation are required

e. Development of evaluation mechanisms and feedback loops to determine the effectiveness of the information supplied and the requirements for new information

f. Recommendations for local systems to follow in improving the internalizing of R and D information and in facilitating the innovative process

g. Summary of services which would be provided and maintained by the Laboratory.

In carrying out this role, the Laboratory will have to develop expertise in those subject areas it intends to teach. By virtue of the course design and instruction process, the Laboratory will be establishing itself as a referral center, not unlike the National Referral Center for Science and Technology. That is, the Laboratory will have to become knowledgeable about all organizations and individuals who have specialized information capabilities in fields of interest in educational R and D. This referral capability could be offered as a service of the Laboratory and is appropriate to the Laboratory's program functions.

American Institutes for Research (AIR) is developing a series of instructional sessions for orienting users to the applications of modern information systems in the behavioral sciences. The Laboratory could capitalize on the AIR work in developing its own, more specialized course. Then, once the training program has been developed and demonstrated at the Laboratory, it could be moved down to the state college or local school level as a regular preservice/inservice training device, or, it could be moved laterally or upward as a logical function of some other agency of the U. S. Office of Education. It may be that all regional laboratories might adopt it as a regular function.

2. Preparation of Interpretive Summaries. The U. S. Office of Education has announced its intention to allocate increased funds for grants and contracts which support analysis of research that may benefit individuals implementing changes in educational institutions. The NEA Division of Research has issued three summaries of research in given areas. Other attempts to meet this need are scattered and therefore insufficient.

The Laboratory's function here would be primarily to develop a model interpretive summary which maximizes utility to school personnel. The development of such a model would require the production of several prototypes which transmit useful information while serving the R and D function. Design criteria for the summaries derived from analysis of user requirements include the following:

a. Subject areas should be selected on the basis of user interest priorities.

b. Information content should be organized to match the requirements of functions in the innovation process; that is, there should be appropriate packages for those in the search, testing, or evaluation modes. Current studies of change processes in education should be investigated prior to package design.

c. Content should also present all important information elements which affect change. It should include both technical and administrative and positive and negative elements of significance to school operating functions.

d. Presentation methods (media, format, timing, etc.) must account for differing characteristics of the audience, which may be composed of teachers, school administrators, district technical and administrative staff, or lay public.

e. The design should answer the user's questions in his own terminology and should perform the translation function to overcome language and information display problems inherent in a presentation of R and D data to non-researchers.

f. The design should take into account expressed needs of the user population: time limit, attractive packaging, and personal interaction. The criterion of personal interaction is critical in establishing credibility not so much for the package itself as for the procedures adopted for its use in the school environment.

A collection of materials in the selected subject area should be started in order to prepare prototype summaries. The extent to which the collection grows will depend on these factors: policy adopted regarding the comprehensiveness of the initial documentation effort, maintenance and updating of such documentation, and position of the Laboratory as an expert open to inquiry on any aspect of innovation in the given area. All of these factors deserve careful consideration because, upon seeing the first prototype, users will make certain assumptions about Laboratory capabilities and will also develop expectations about future Laboratory products and services.

Collections of reasonable size could be maintained without resort to mechanized handling methods. Furthermore, if production of these summary packages is turned over to some other agency (hopefully the ERIC clearinghouses), none would have to be retained in the Laboratory. It might prove helpful, however, to maintain bibliographies in machine-readable form which would be useful to the permanent curator of the subject area.

3. Annual Review of Educational Research and Development. A task which would yield a product of great value to the educational community, and which might be appropriate for the Laboratory, is the preparation of an annual review of research and development in educational innovation. The specific model for this alternative role is the Annual Review of Information Science and Technology, edited by the staff of System Development Corporation (SDC). In the production of the SDC document, a review board first establishes the scope of the review, develops an organization to accomplish the task, and deals with funding issues, such as grant requests or relationships with publishers. SDC then selects an editor to produce as complete a bibliography as possible of literature published in the designated period. The editor gives appropriate sections of his bibliography, as well as instructions regarding format, page limitation, etc., to distinguished workers in each field who write the chapters of the document. Their first drafts are then distributed to competent individuals whose critiques are subsequently returned to the writers for incorporation into the final text. The editor organizes the finalized material and handles coordination with the publisher to produce the completed document.

The SDC example clearly illustrates how such a task can be organized and accomplished. Although the actual staff requirements for this undertaking are small, the need for extensive and efficient coordination is paramount. The Laboratory is well-organized and well-situated enough in the educational community to assume such a task and might, as a result, become pre-eminent in the following areas:

a. Knowledge of progress in educational research and development. Although a good document would certainly advance the overall position of the Laboratory, the risk and the impact of producing a less than competent review should be considered.

b. Knowledge of the relative value of innovations, the validity of current work, and the direction of future efforts. Such knowledge would be valuable in shaping other elements of the Laboratory's programs.

Moreover, the construction and maintenance of a bibliography on the fields or subjects chosen for review might yield a separate product (as SDC found) of publishable quality.

A definitive review would be a basic reference tool for the researcher and the innovator. It would also foster new projects with improved focus and more narrowly defined objectives. For more conservative school personnel, the document would serve both the general and focused search functions by providing evaluative information in several subject areas of direct interest.

system--teachers and curriculum specialists--have consistently emphasized the need for in-district assistance in obtaining and interpreting information. Component 3 is clearly responsive to this need.

The Task Force recommends that the emphasis of this component be directed toward the service described in Alternative 1 (training information specialists). We believe that the availability of such specialists in districts would have a "seeding effect," i.e., it would create an obvious need for a local information system to support instructional innovation. The specialist would serve both as an information resource and as a basic component of that local information system.

VII. SUMMARY

The Task Force on information system design requirements believes that the alternative courses of action it has proposed for the Far West Laboratory are consistent with the description of the Communication Program in the 1967 Annual Report. This belief is supported by testimony from researchers, school administrators, teachers, federal, state and county staff members, and its own consultants.

A. Component 1

Component 1 of the Laboratory's Communication Program proposes to use general communications media to develop an awareness, among the educational community and the public, of opportunities available for instructional improvements. The Task Force found ample evidence that willingness to critically evaluate present and alternative practices is crucial to meaningful improvement of instructional procedures in the public schools.

The means and media to create such a climate, however, are not easily discernible. Whether meetings, direct mail, television broadcasts, or other media are most effective should be carefully evaluated before substantial resources are committed to Component 1. In general, we suggest that the highest credibility will go to media which can be adapted to the widely varying interests and roles of those groups which should be receptive to educational innovation.

B. Component 2

Component 2 is concerned with the design, development, field testing, and implementation of a system for production, storage, retrieval, and distribution of educational information. Recommendations 2 (interpretive summaries) and 3 (annual review of educational research and development) of the Task Force are consistent with this component. Evidence from a variety of sources revealed to the Task Force that the lack of interpretive and evaluative summaries is the greatest single impediment to teachers' use of R and D information. Although all segments of the educational community deplore this inadequacy, no one is prepared or plans to satisfy the need in any systematic manner. We believe strongly, therefore, that the Laboratory's development of a model for the preparation, production, and distribution of evaluative and interpretive summaries, as well as the preparation of critical reviews, will be major contributions to the effective functioning of the information system serving public education.

C. Component 3

The third component seeks to develop and evaluate arrangements within schools that will facilitate the use of educational R and D information. The chief users of the educational information system--teachers and curriculum specialists--have consistently emphasized the need for in-district assistance in obtaining and interpreting information. Component 3 is clearly responsive to this need.

The Task Force recommends that the emphasis of this component be directed toward the service described in Alternative 1 (training information specialists). We believe that the availability of such specialists in districts would have a "seeding effect," i.e., it would create an obvious need for a local information system to support instructional innovation. The specialist would serve both as an information resource and as a basic component of that local information system.

APPENDIX

I. Work Session on User Requirements - July 27, 28, 29

A. Agenda. Three items were considered in testimony and discussion on this topic:

1. Present information needed about educational R and D projects; search strategies used to obtain information; decision-making processes followed in the utilization of information by teachers, principals, curriculum and research specialists, district administrators, school boards, and lay citizens.

2. Differences in user requirements due to such factors as grade level, types of students, school environment, and the size, location, and wealth of the district.

3. Potential requirements of individuals listed under 1 above in terms of the following questions: What kinds of information are needed? What kinds of format are required? Who needs the information? How much information is needed and how quickly? Where and how will it be used? What will be the short- and long-term effects of supplying the information?

B. Participants.

1. Far West Laboratory:

John Hemphill, Director
George Rusteika, Deputy Director
Paul Hood, Program Director
David Carlisle, Program Associate

2. Conference Consultants:

Robert Coney, Alameda County Schools
Marvin Hockabout, Alameda Unified School District
Vern Plaskett, Lockheed Missiles and Space Company
Robert Roggenbuck, U.R.S. Corporation

3. Session Consultants:

Virgil Blanke, Ohio State University
Wayne Otto, Research and Development Center, University of Wisconsin
Richard Schmuck, CASEA

4. Participants:

Roy Archibald, National Education Association
Ernest Aveliar, Hayward Unified School District
Alden Badal, Director of Research, Oakland Unified School District
Edward Bispo, California State Department of Education, Office of Compensatory Education
James Butler, Executive Secretary, Nevada State Education Association
Roger Chapman, Director, San Mateo Educational Supplementary Center
Maury Chorness, Stanford Research Institute
John Church, California State Department of Education, Curriculum Development
Edwin Coffin, Superintendent of Schools, Monterey County
Richard Conniff, Superintendent, Alum Rock Union Elementary District
Alvin Cressman, Calfiornia State Department of Education, Systems and Data Processing
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Tamar Holpin, Oakland City Unified School District
Donald Johnson, California State Department of Education, Program Planning and Development, ESEA
Russell Kent, Superintendent of Schools, San Mateo County
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Pauline Levie, San Francisco Unified School District
Edmund Lewis, Executive Secretary, California School Board Association
William Merz, Clark County School District, Research and Project Design
Renato Nicolai, South San Francisco Unified School District
Berney O'Haire, Napa Valley Unified School District
Leo Palmiter, Assistant Superintendent, Sacramento County
J. Win Payne, Superintendent, Napa Valley Unified School District
Carl Rittenhouse, Stanford Research Institute
James Smith, San Juan Unified School District, Reimbursable Programs
Wayne Sorenson, Hayward Unified School District, Educational Research and Development
Ray Sweigert, California State Department of Education
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Mary Tsukanato, Elk Grove Unified School District
Glenna Violette, Sequoia Union High School District
Betty Ward, Monterey County Schools
Hal Weatherby, California Teachers Association, Research Department
Ursula Westcamp, Folsom-Cordova Joint Unified School District
Jerry Witt, Alum Rock Union Elementary School District

II. Work Session on the Content, Organization, and Location of Information - August 15, 16, 17

A. Agenda. Presentations and discussion were organized around three questions:

1. What types of information can be obtained from such sources as research reports, curriculum libraries, abstracts, indexes, workshops, professional organizations, etc.? How often are these sources used? Are there other possible sources?

2. How is the information organized and what search strategies are being employed? What information can be found easily and what cannot? What is being done about indexing, evaluation, quality control, translation, interpretation, format, and simplification of the information?

3. How can the present situation be improved?

B. Participants.

1. Far West Laboratory:

Paul Hood, Program Director, Communications Program
David Carlisle, Program Associate, Communications Program

2. Conference Consultants:

Robert Coney, Alameda County Schools
Vern Plaskett, Lockheed Missiles and Space Company
Robert Roggenbuck, U.R.S. Corporation

3. Session Consultants:

William Gephart, Phi Delta Kappa
Robert Gagné, University of California, Berkeley, School of Education
John Loughary, University of Oregon, School of Education

4. Participants:

Frank Burke, Stanislaus County Schools
Maury Chorness, Stanford Research Institute
Edwin Coffin, Superintendent of Schools, Monterey County
John M. Davidson, Davidson Films
Rosemary Glenn, Contra Costa County Supplementary Education Center
Urania Gluesing, San Francisco State College
Harold Gluth, Stanislaus County Schools
Margaret B. Johnson, University of California, Berkeley
Richard Lewis, San Jose State College

Glenn McMurry, University of Southern California, Department of Institutional Technology

Charles O. Moody, California State Department of Education, Bureau of Elementary and Secondary Education

Mary Jane Parker, Stanford Research Institute

Ann Protopopoff, California Teachers Association

David Rawnsley, San Mateo Supplementary Education Center

Carl Rittenhouse, Stanford Research Institute

Mimi Sayer, San Francisco State College

Carl Stutzman, California State Department of Education, Office of Compensatory Education

Ray Sweigert, California State Department of Education, Program Planning, Title III, ESEA

Beatrice Ward, Project EDINN

Robert Weisgerber, American Institutes for Research

Alan Wolstencroft, San Francisco State College

III. Work Session on Information Systems and Technology - August 22, 23, 24

A. Agenda. Given data obtained from sessions on user requirements and sources of information, this session examined and recommended possible systems for development by Laboratory staff. Possible processes for such items as acquisition, indexing, abstracting, retrieval, and present and future technology were described in terms of their advantages and disadvantages and approximate cost.

B. Participants.

1. Far West Laboratory:

Paul Hood, Program Director, Communications Program
David Carlisle, Program Associate, Communications Program

2. Conference Consultants:

Robert Coney, Alameda County Schools
Vern Plaskett, Lockheed Missiles and Space Company
Robert Roggenbuck, U.R.S. Corporation

3. Session Consultants:

Robert Hayes, UCLA, School of Library Science
Harold Borko, System Development Corporation

4. Participants:

David Rawnsley, San Mateo County Supplementary Education Center
Carl Rittenhouse, Stanford Research Institute
Ray Sweigert, California State Department of Education, Program Planning, Title III, ESEA

IV. Recap Session on User Requirements

A. Agenda. Participants conducted a reexamination of information gathered at the first work session on this topic.

B. Participants.

1. Far West Laboratory:

Paul Hood, Program Director, Communications Program
David Carlisle, Program Associate, Communications Program

2. Conference Consultants:

Robert Coney, Alameda County Schools
Vern Plaskett, Lockheed Missiles and Space Company
Robert Roggenbuck, U.R.S. Corporation

3. Participants:

Lily Lahti, Coordinator, Instructional Materials, Acalanes Unified School District
Peter Lamb, Director, Secondary Instruction, San Lorenzo Unified School District
Ronald Leppke, Guidance Consultant, San Ramon Unified School District
Albert Mayrhofer, Coordinator, Instructional Materials, San Mateo Unified School District
Allan Petersdorf, Director, Elementary Instruction, Hayward Unified School District
Donald Russell, Director, Elementary Curriculum, Mount Diablo Unified School District

V. Work Session on National, Regional, State and County Roles and Relationships - August 28, 29

A. Agenda. After a review of the three previous sessions, consideration was given to dissemination efforts not only of the organizations represented at the hearings, but also of the following agencies:

1. Other U. S. or State Department educational agencies
2. Other U. S. agencies, such as OEO, Job Corps
3. Private foundations
4. Colleges and universities
5. Military and industrial educational systems
6. Para-educational agencies
7. Other educational associations.

In addition to ERIC and SRIS, other planned or operating national information services were discussed in terms of the following questions:

1. What are they?
2. What are they doing or planning to do?
3. What are possible areas of cooperation between the Laboratory's system and these networks?

B. Participants.

1. Far West Laboratory:

Paul Hood, Program Director, Communications Program
David Carlisle, Program Associate, Communications Program

2. Conference Consultants:

Robert Coney, Alameda County Schools
Vern Plaskett, Lockheed Missiles and Space Company
Robert Roggenbuck, U.R.S. Corporation

3. Participants:

Kenneth Brown, California Teachers Association, Office of Instructional Services
Lee G. Burchinal, U. S. Office of Education, Division of Research, Training and Dissemination
John Church, California State Department of Education, Division of Instruction
Rosemary Glenn, Contra Costa County Supplementary Education Center
Glenn Hoffman, California School Board Association
James P. Kiley, Nevada State Department of Education, Instruction Division

Donald Mahler, California State Department of Education, Bureau of Educationally Handicapped and Mentally Exceptional Children

Mrs. Chase McJunkins, California State Department of Education, Title I, Office of Compensatory Education

Charles O. Moody, California State Department of Education, Bureau of Elementary and Secondary Education

David Rawnsley, San Mateo County Supplementary Education Center

Carl Rittenhouse, Stanford Research Institute

Myron Schussman, San Mateo County Schools Office

Carl Stutzman, California State Department of Education, Office of Compensatory Education

Ray Sweigert, California State Department of Education, Title III, Division of Instruction

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